Omni Controller: A multi-functional competitive gaming controller designed for accessible one handed use.

Research Thesis

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by

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OMNI CONTROLLER

A multi-functional competitive gaming controller designed for accessible one handed use.

HARRISON MOSHIER • INDUSTRIAL DESIGN



INTRODUCTION

RESEARCH

SOLUTION

INTRODUCTION

PROBLEM

Many social activities require the use of two arms. This leads to children and young adults being left out of social activities, such as competitive gaming. When you play online, you are only judged on your game-play ability, but due to the current market, those without the use of two hands miss out on the opportunity to socialize and profit from the growing popularity of competitive gaming.

OBJECTIVE

I propose to create a controller which brings those with use of only one hand into this community. The controller needs to be lightweight to prevent fatigue and allow extended use. It also needs be used with only one hand, but can utilize other body parts to control buttons used more often. Button mapping should be used to fit the needs of multiple users based on ability. The design quality needs to match or exceed that of current controllers to keep a level playing field. The controller should be accessible by all one handed players, regardless of ability and must be playable by a wide audience.

CURRENT MARKET

The current market has a severe lack of universally accessible products. This does not mean there are none on the market. After interviewing and surveying multiple people who have use of only one arm, I have some insight into the physical and social issues these people face on a daily basis. I also explored the current market of devices meant to connect people through technology such as different video game controllers as well as one specifically developed for one-handed play in mind.

I explored current options for gamers facing multiple physical disabilities as well as devices designed for competitive gaming. These are just a few articles I had found in my research which help highlight the issues real world people face.

There are a lot of things in our world that are inaccessible – from a step into a restaurant to toilets that aren't adapted. Disabled people sometimes get left on the sidelines, unable to participate. Thankfully, that isn't the case for a lot of gaming consoles.

Let's face it, companies want you to buy its games. We, as a community, are a target market that is worth selling to. So developers will try to help disabled people out, even if it takes time.

Philip Hoare's comment on The disabled gamer's manual, *http://disabilityhorizons.com,* October 19 2017

I am a avid pc gamer that plays with only one hand. I suffered a stroke like attack several years ago and lost the use of my left hand.

I currently play Dota 2 with the Logitech g600 mouse and it works fairly well. I have tried various mice: naga, warmouse, sandio 3d.

The g600 is the best all around for me. The sandio 3d is great for FPS though since it has a side mounted joystick for movement..

Click to move games are easier to play with one hand as well as MMOs that allow you to move by holding left and right mouse buttons. WASD games are possible, but not as easy.

Krystom's comment on r/pcgaming, *www.reddit.com,* October 30 2016

I don't know how long I've played claw because I picked it up naturally and didn't find out it was called "claw" until my late teens, but it really does highlight the inefficiency of most controller designs.

I pick up an Xbox One Elite controller shortly after it released, and it has been a Godsend. I've never delved deep into 3rd party controllers because the few I've used felt cheap to me, but the revelation of paddles on the back of a controller changed my life.

Sadly, I can't use paddles with much efficiency because I can't consistently practice with them and I'm trying to overwrite 20+ years of muscle memory. When I do used them, though, I don't have pain surging through half my hand at the end of a lengthy gaming session.

Stairmasternem's comment on "The Quest To Make A Better Video Game Controller" By Kirk Hamilton, *Kotaku,* February 21 2018

Hiya, one-handed PC gamer(former) here. I am really keen on getting disabled gamers aware of the great utility in voice control these days, as I find voice along with foot pedals and a gaming mouse allowed me to play almost any genre.

Foot pedals are great but I found over time the cheaper ones broke so ended up spending a bit over $100 on the Stinky footboard. It's really well engineered and I use it also on things like Photoshop & Lightroom.

I retired gaming a year ago when our first child was born, and my chronic pain started causing big issues with free time, so can't recommend any games off-hand sorry.

GhostDoj's comment on r/gaming, *www.reddit.com,* November 13 2015

PLAYTHROUGHS, REVIEWS AND ACCESSIBLE GAMING

Interview with Andrew Monkelban, By Harrison Moshier

"My name is Andrew Monkelban, and I was born with cerebral palsy, which has rendered me unable to walk, talk and only able to use my right hand, hence why my streams say "One-Handed." In reality though I mainly only use my thumb and middle finger, although I do throw in my index finger sometimes. Along with some JRPGs, I stream games that you wouldn't think could be played with two or three fingers.

On Twitch, I go by the moniker of ShouraiLive, although I just tell everyone to call me Shou (pronounced "Show") to make it easier, hence my Twitter and Discord name as well as my hashtag, ItsShouTime.

I began streaming in 2013. I refuse to call myself a disabled streamer. To me, I'm just a streamer who has cerebral palsy. Is Joe Shmoe who wears glasses and streams, a "disabled streamer"? Or is a guy that knits, a "male knitter"? No, that's just ridiculous."

How often do you play video games?

I play video games everyday, for upwards of 8+ hours. As you know, I have my twitch channel which I stream almost every day on, playing games for hours on end.

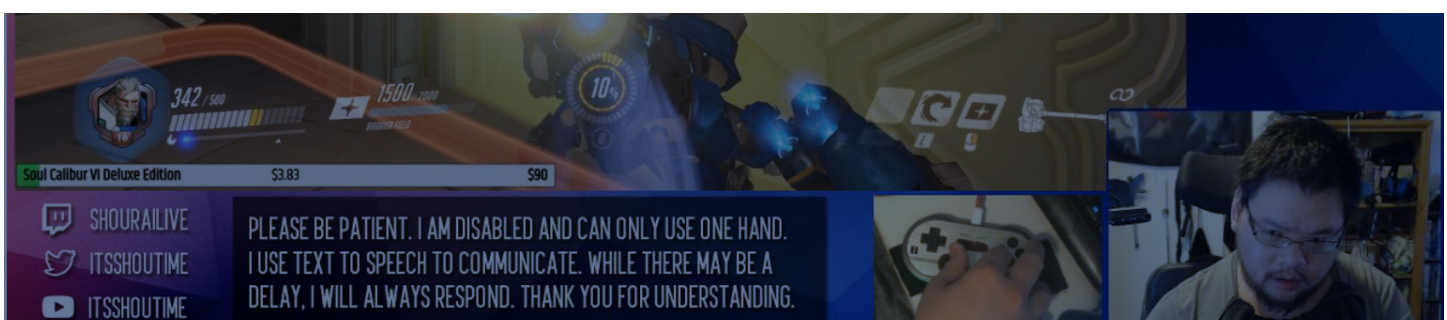
Are games your primary source of social community or do you participate in any clubs or recreational activities?

I frequent numerous Discord servers, not to mention Twitter and Reddit. I mostly interact with others online through the use of these social media sites I have mentioned.

Do you play video games socially, or do you mostly play solo campaigns or against A.I.?

Whether or not I play video games socially really depends on the kind of game. For example, I play Tekken 7 socially (and competitively), but say God of War, I obviously play solo.

How does the limited use of your hand affect your game-play?



The limited use of my hand has affected my game play in that it limits the types of games I can play. There are exceptions, but for the most part, I cannot play Shooters.

Being only able to use my right hand, I'm always looking for peripherals that will make things easier for me, whether it's using the computer or gaming. Over the years, I have used a number of different controllers, and have contemplated getting a custom controller like a SCUF, but ultimately, the cost has deterred me.

Do you prefer to play games on a desktop or home console?

I prefer console, as that's how I grew up. I do play on PC some, but I always go back to console. Mostly I enjoy playing games on my Playstation 4. The games I review are usually played on my PS4, but I do also enjoy playing my Nintendo Switch.

Have you tried using any 1st party controllers for consoles such as the Xbox, Playstation and Nintendo home consoles?

Who hasn't tried first-party controllers? After all, they come standard with the console. My favourite is the PlayStation's DualShock series. It's very rare that I do not like first-party controllers, but the Nintendo Switch's Joy-Cons are one such example. They have no weight to them and when in the Grip, they sit at an odd angle on a table which makes them impossible for me to use.

Do you think there are any successful accessible controllers on the market?

With the exception of perhaps the Xbox Adaptive Controller, which I have not used yet, I do not think there are any successful accessible controllers on the market.

However, the controller I currently use is the F30 Pro which works enough for me to get by. The main reason why I got the F30 Pro is the shoulder buttons. Unlike being below L and R like on every other controller on the market, ZL and ZR (L2 and R2) are next to them on the F30 Pro. For me, this makes them easier to press and makes the controller more accessible, one-handed. I can now press all of the shoulder buttons, without having to reach around under the controller. I've been using the F30 Pro for two months now, and overall, it's been wonderful to use. You have no idea how great it feels to be finally able to use the entirety of a controller.

That being said, the F30 Pro is by no means perfect. The one glaring issue that I have is that the thumb rests on the analogue sticks are tiny. They're about half the size of the standard ones, smooth and glossy, which doesn't make it easy for me to keep my thumb on them. Another issue I have is with the face buttons. They seem to be a bit too "clicky" for my tastes. I'm used to them easing back up when I let go. These buttons, however, spring back up, which is still a bit jarring. You can still activate the buttons, but it feels weird. The last problem that I have is more of a nuisance. Each time you turn the Switch and F30 Pro on, you have to put it into Switch mode, which is done by holding Power+Y for one second. You have to do this every single time.

If I were to design a solution to the issues around accessible gaming, would you rather see an accessory which connects to any controller to make it accessible or a new controller which is accessible to use from the start?

Well, considering there are accessories that connect to a controller to make them accessible (namely the Avenger Reflex from N-Control, and my favourite, the PS4 StrikePack F.P.S. Dominator from Collective Minds Gaming Co. Ltd.), I would prefer a new controller which is accessible to use from the start. I would love one that has all four shoulder buttons on the face.

Mass-produced accessible controllers are hardly commonplace. While this is unfortunate, it's also the truth. Most times we have to rely on the modding community for accessible controllers. Luckily, the UK-based ConsolesandGadgets.com has released their "PS2 One Handed Controller." The PS2 One Handed Controller seems to be a reproduction of the now-discontinued DragonPlus RPG Duo Con 2. I say "seems," because I've never had the latter, only the former. I came across the PS2 One Handed Controller while researching accessible controllers, a couple years ago. While it did take me a year to purchase one, and it's far from perfect; I can say that it's one of the best buys I've made.

Have you tried using VR or AR for games and if so do you think it is more accessible than console or desktop gaming?

The technological advances never cease. Computers and gaming consoles get faster and more powerful. Virtual reality is becoming an actuality. Even motion-sensors are getting smaller.

I have tried VR, and I can safely say that it is more inaccessible than both PC and console gaming. Especially for those of us that only have use of one hand, and are in wheelchairs.

I have however used motion tacking devices, and tracking is pretty accurate and with very low latency. What this means is the devices recognizes your movements in real-time. This is a very good thing, because as a gamer and even a general user, any sort of input delay can be a hassle. The device I used also recognizes finger movements fairly well, so you can pick up objects on screen. You can also utilize real-world objects to use the device, such as a pencil or chopsticks. This is a tremendous plus for individuals who can't use their hands.

EXPERIENCE MAP

GUIDING PRINCIPLES	People with the use of one arm are limited in a two arm designed society.	Purchasing a controller to play video games with requires a lot of research.	Playing competitive games is more stressful due to the pressure to perform.

STAGES	Planning	Practicing	Playing	Performing
DOING	Go to the store and choose the best controller for the game you are trying to play. Research accessibility before purchase. Cross platform controller works best so you don't have to special order a controller for each device. 	Before starting an online match you must practice. To remain competitive you need to improve your game and learn the new controller you purchased which was not designed for one handed gameplay. 	In the match lobby you must choose a class or player which best fits your gameplay style as you have limited camera movement due to the joystick placement on every controller. This means you are limited in your gameplay. 	The pressure is on to succeed on your team as you are communicated with the players on your team. Chances are you will stick together if the team is successful, but if not you will find a new lobby and never meet anyone on your team again. 
THINKING	"What is the best controller option for me" "What is the most affordable"	"Why is this controller so hard to use?" "Why doesn't this work on my other devices as well?"	"What happens if someone better than me wants to be the only character I can play?" "How can I play other characters with only one thumb-stick"	"What happens if I'm failing and my team yells at me?" "How can I join a lobby and people want to keep playing with me?"
EXPERIENCE	Stress Level Comfortability Assistance Provided	Stress Level Comfortability Assistance Provided	Stress Level Comfortability Assistance Provided	Stress Level Comfortability Assistance Provided

OPPORTUNITY	CONTROLLER	EXPERIENCE
	A new universal controller could be made to fit the needs of all users. This controller would be cross platform, or available as a replacement for the standard controller which currently exists.	Gaming could move from a controller based experience to something motion oriented. Potentially thoughts or eye movement could be utilized in motion of your player.

Based on survey results I pulled after posting on various reddit and facebook groups, I created an experience map. This shows the process of typical competitive gaming and helps identify pain points.

MARKET ENTRY

To research accessibility in products in person, I went to multiple electronic retailers to look at different social video game controllers. I classified social video game controllers as electronic devices which control the interaction between the user and application, specifically for applications which are game related and promote social behaviors.

Based on my findings, the more competitively viable a controller is, the less accessible it is. Competitively viable controllers require a lot of dexterity from each hand working together. This is because of the number of buttons needed to be pressed.

USER RESEARCH

“I just want to hang out with friends and. Having one arm doesn’t keep me from any clubs or activities.”

Age: 16

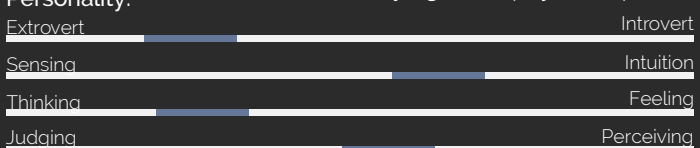
Home Life: Alex lives with her mom and is a sophomore in high-school.

Relationship: Alex enjoys playing video games with her friends and is on her school’s robotics and track and field teams.

Goals:
-Participate in school events
-Spend time with friends

Frustrations:
-Can’t always play same games as friends
-Playing more physical sports

Personality:



“I refuse to call myself a disabled streamer. To me, I'm just a streamer who has cerebral palsy.”

Age: 28

Home Life: Andrew lives with his dad and streams video games daily to raise money for more games. He reviews technology and writes on his blog.

Relationship: Andrew spends most of his time streaming and connecting with viewers as well as frequenting reddit and discords online.

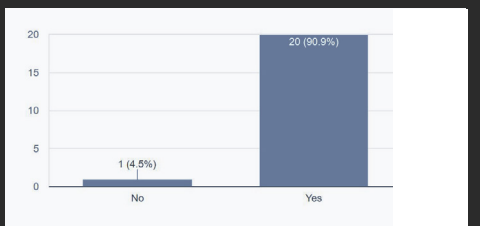
Goals:
-Have a successful business
-Get new games to stream

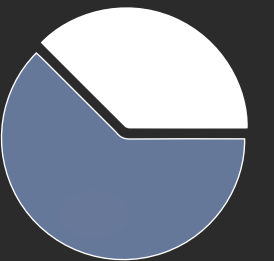
Frustrations:
-Playing any shooting games
-Building and audience

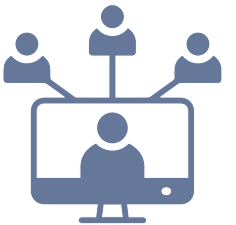
Personality:

Data used in this info-graphic was pulled from poll response of a group of 21 people.

AGE DEMOGRAPHICS



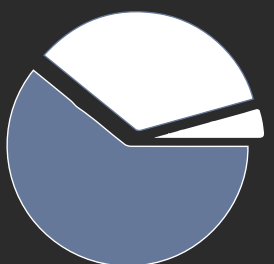




74% of surveyed people play mobile games

91% of surveyed people see a lack of accessible controllers in the current gaming market

63% of surveyed people video games an important part of your social life



61% of surveyed people play on home consoles while **35%** play on PC

57% Prefer controller

43% prefer keyboard

ERGONOMIC STYLE TESTING

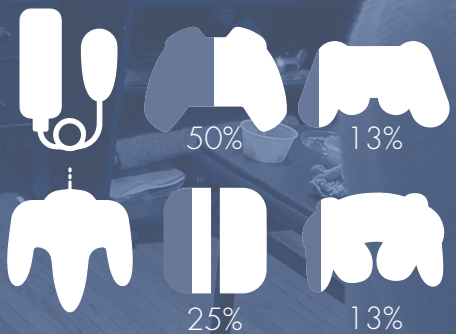
For this evaluative method, controllers from five different consoles were laid out for participants to evaluate. Users familiar with gaming were brought in to select their top two most ergonomically successful (with two hands) controllers. They were then asked to re-evaluate each controller from a one handed mindset, evaluating **button access** and **thumb stick usage**.

TAKE AWAY

This method gave valuable insight into what competitive gamers look for in controllers for a successful gaming experience. This shows me what the focus needs to be in a one-handed controller with features such as button mapping or location. I was also able to see how each player tried grabbing six different controllers with one hand which also helped me see what was most important for a successful experience.

The most important touch points are the tools which allow you to successfully compete in competitive gaming. Social, able gamers can give insight into what makes controller design successful and by establishing a one-handed mindset.

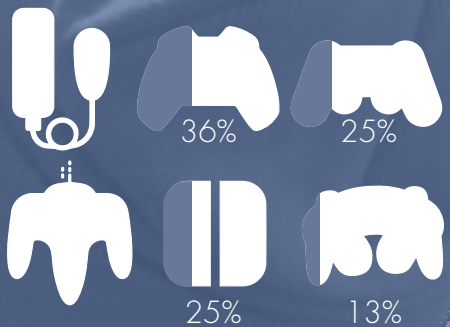
TWO-HANDED



REFLECTION

- “I like the Xbox controller best because it has a good grip“
- “The N64 controller has a cluttered interface and is too hard to interact with.”
- “The PS4 controller is the most comfortable.”
- “The Switch is easiest to hold, being able to carry a controller in each hand is comfortable.”
- “The thumb stick smoothness and triggers are most important to me.”

ONE-HANDED



REFLECTION

- “I need to turn the controller 90 degrees to play with both thumb sticks“
- “If I had a foot pedal to control movement, this would be much easier.”
- “I like the GCN controller because I can reach the triggers easily.”
- “The Switch would be best if I could stably hold both Joy-Cons in one hand.”
- “I like the Xbox because the thumb sticks aren’t too close and I can easily reach all buttons.”

PLAY ACTING

For this evaluative method, gaming systems were set up with Fortnite across four platforms: **Playstation 4, Xbox One, PC** and **Switch**. Users familiar with competitive gaming were brought in to play one round of Fortnite on each console. Responses to the method were recorded and participants ranked the successfulness of each controller's one handed game-play.

TAKE AWAY

This method gave valuable insight into how competitive gamers adapt to a one-handed environment. Their insight helps in development of a device which lets one handed gamers perform at the same, if not higher, level of game-play. Keeping the game uniform across all platforms lets me get a consistent reading from each of the player's experiences.

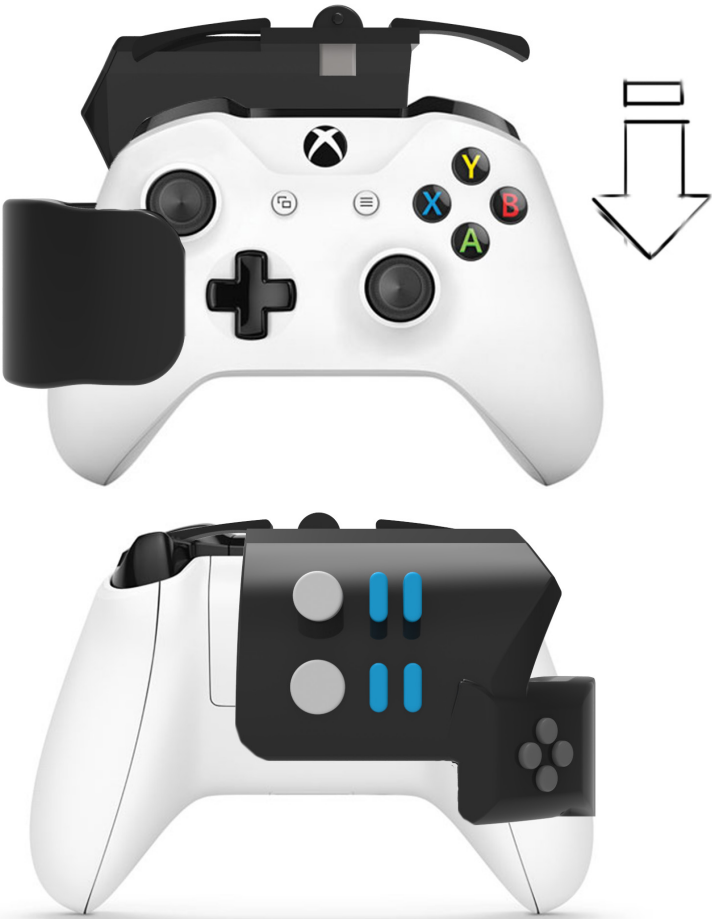
The current competitive gaming market does not sufficiently account for those who need to play competitive games with the use of only one hand. Current console and PC gaming platforms lack accessibility and need solution exploration in the use of thumb sticks and trigger buttons.

	OBSERVATIONS	CONSOLE	QUOTES
PARTICIPANT A	• Player used knee to control second analog stick		“Holding a controller gives my hand a huge cramp.”
PARTICIPANT B	• Player turned controller horizontally to play		“I don’t think I can play this way for very long”
PARTICIPANT C	• Player set controller on table to hold controller stable		“Oh no, I just realized I can’t reach the triggers to shoot.”
PARTICIPANT D	• Player turned controller horizontally to play		“This is the worst thing I’ve ever tried to do.”
PARTICIPANT E	• Player set controller in lap to hold steady to play		“Using these buttons mapped on the mouse is much easier.”
PARTICIPANT F	• Player set controller in lap to hold steady to play		“If the Joy-cons connected this would be great.”
PARTICIPANT G	• Player turned controller horizontally to play		“Aiming is almost impossible with my pinky.”
PARTICIPANT H	• Player used knee to control second analog stick		“I can not aim with my knee at all.”

CONJECTURE #1

The idea behind this device is to create a cheaper option for those needing to play their favorite video game systems with one hand. This device connects to any controller's micro USB port and allows the user to re-map the buttons to one side of the controller. This device would have to come in two different versions, one for left handed users and one for right handed users.

The device features an analogue stick re-mapping from the right side to a camera on the top center of the accessory. This allows the user to use slight head and eye movements to control the in game camera. Shoulder buttons are re-mapped to the blue as well. Hitting each button will cause two paddles on top of the controller to fall and hit the shoulder buttons. This accessory is meant to address issues of cost, as well as allow you to not have to purchase a new controller with every new console you buy.

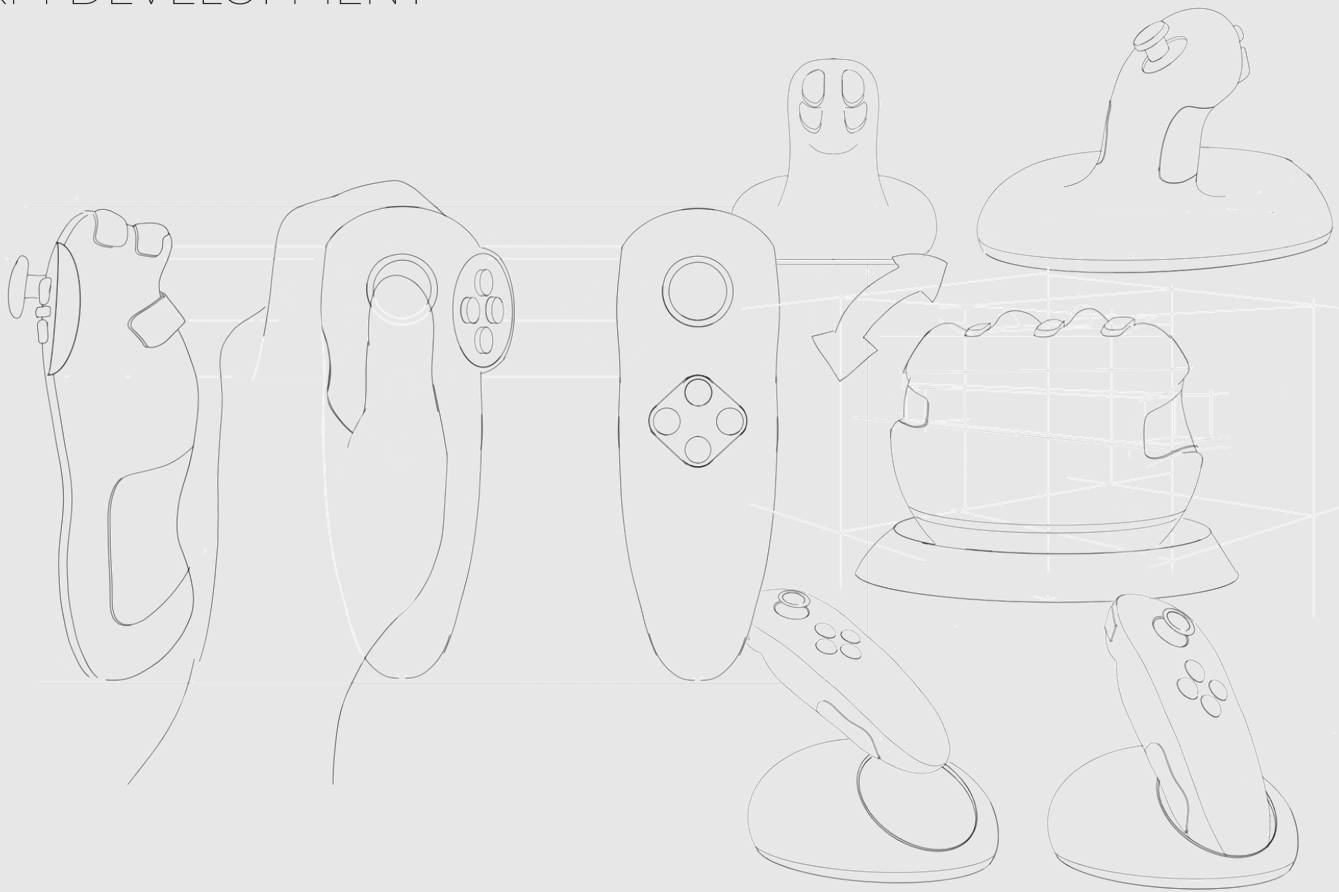


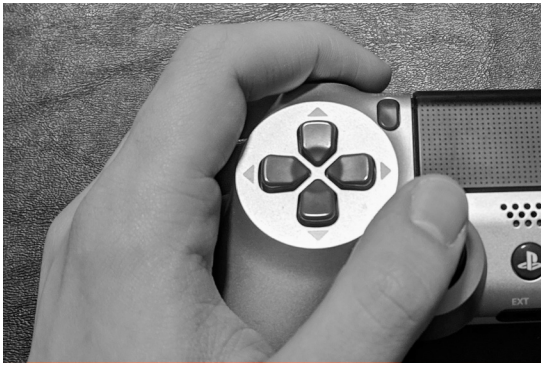
CONJECTURE #2

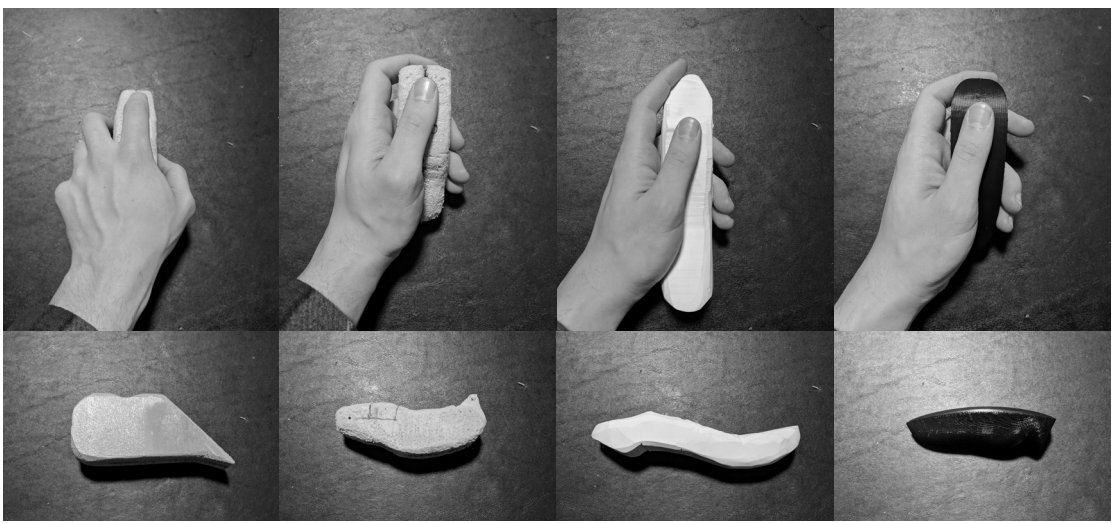
The idea of this controller is that it will be a universal controller which can be held with either the right or left hand. The ergonomics of this controller allow the user to control the movement analogue stick with their thumb, while controlling camera movement with the touch pad. The other buttons are set just above the touch pad so not much movement is needed to go from camera control to other buttons. The shoulder buttons are set just below the touch pad so they can be reached without moving your fingers off the touch pad.

The goal of this device is to be ergonomic and accessible, so the user can use one hand to successfully navigate all buttons and options on the controller. This is meant to address a common complaint I saw with issues in using the shoulder buttons and reaching both analogue sticks with one hand.

FORM DEVELOPMENT



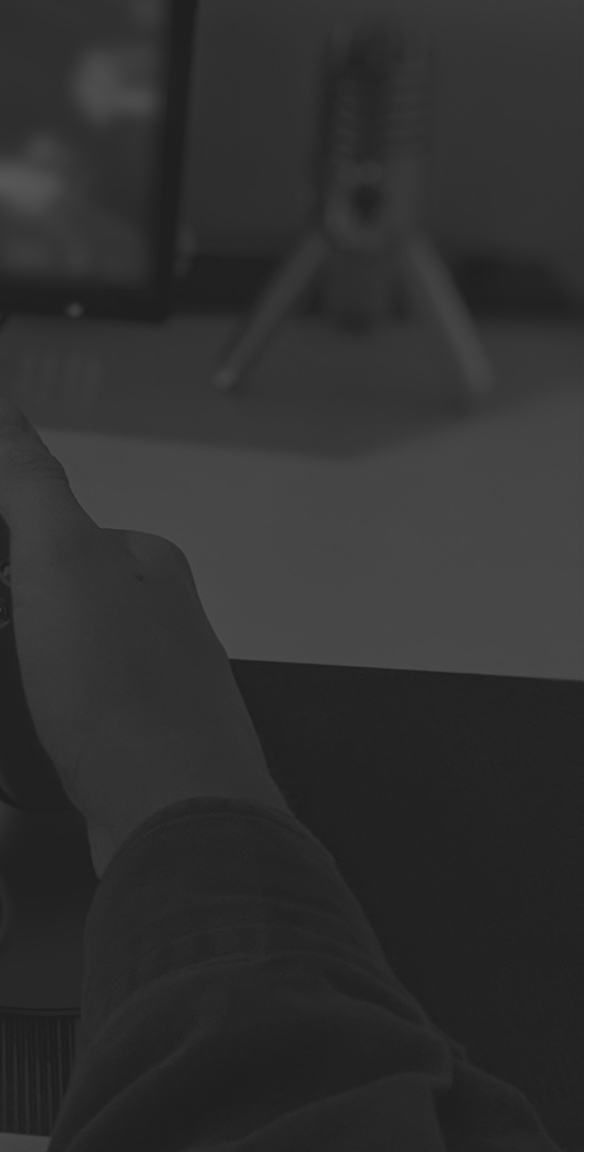




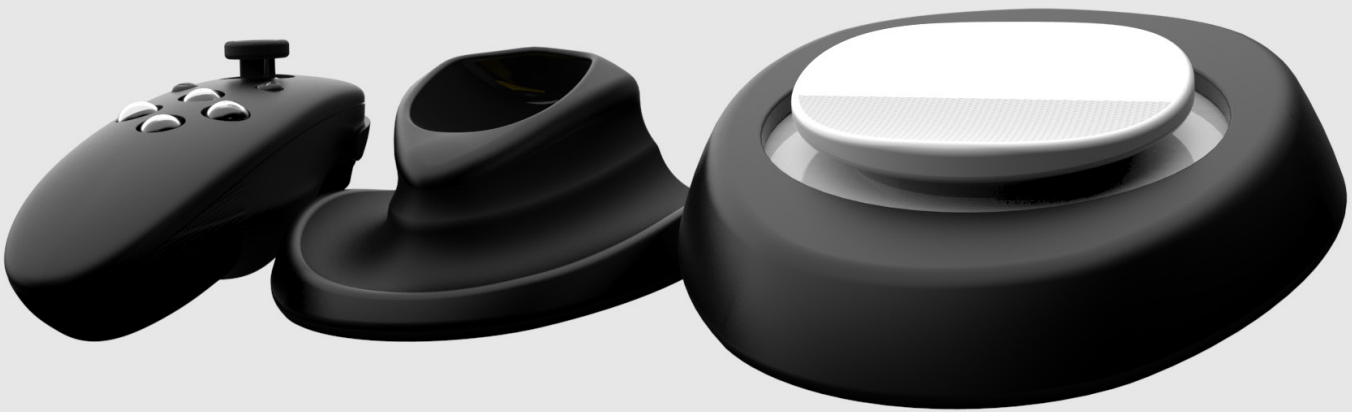
Multiple forms were created for ergonomic testing to ensure the most comfortable grip which allow for the most potential in button access.

APPEARANCE MODELS

SOLUTION



WHAT YOU GET



Each controller works independent from one another, but the **Tabletop** and **Step Controllers** require the **Primary Controller** to fully function. Someone with limited arm mobility would use the **Step Controller** while someone with limited leg mobility would use the **Tabletop Controller**.

Each of the secondary controllers function as secondary analogue sticks and account for a two thumb-stick layout of current competitive controllers. The **Primary Controller** needs to dock in the **Tabletop Controller** to function, but connects wirelessly to the **Step Controller.**

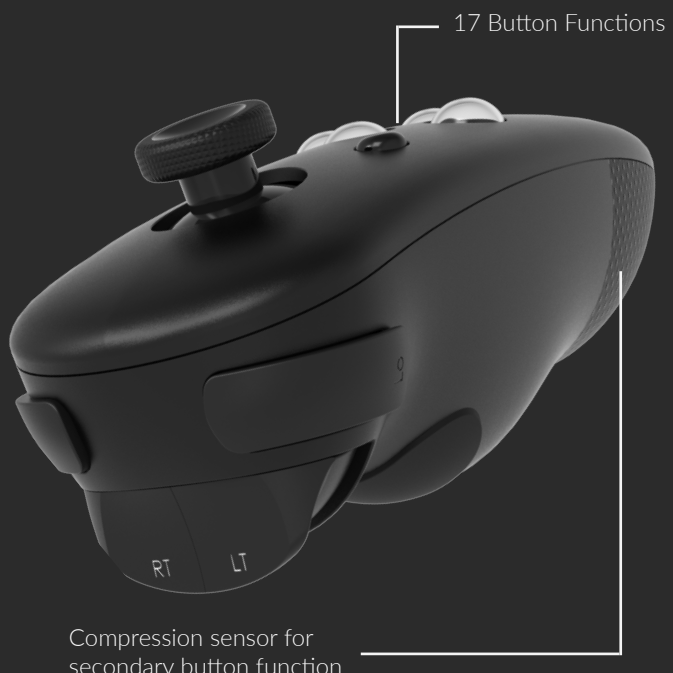

troller
Step Controller

ENHANCED GAMING

The Omni Controller functions at the same level as current competitive controllers on the market. Using only one hand you can easily navigate the same number of buttons as you could on a traditional controller. Using the Primary Controller, you can access the majority of needed functions. Two additional accessories are provided to match ability and more can be attached if needed.

FULLY CUSTOMIZABLE

Buttons can be mapped based on the user's ability and preference. Using pressure from squeezing the controller, the user can trigger secondary functions for each button on the Primary Controller. A Tabletop or Step Controller function as the second analogue stick to the primary controller. Either is chosen based on the user's ability.



ALWAYS CONNECTED

The Omni Controller Step Controller functions similar to a traditional analogue stick. It is angled downward to fit the natural ergonomics of the foot and has a grip placed where your foot is placed. It connects to the primary controller through Blue-tooth connection and is always paired when powered on.

ADDITIONALLY ACCESSIBLE

The Step Controller has three different ports in the back which allow for external accessory connection in case you need a special controller connected. The ports are USB-C, 3.5mm and USB 3.0. The bottom of the controller is made from rubber and will not slip over any surface it sits on.

FURTHER DEVELOPMENT

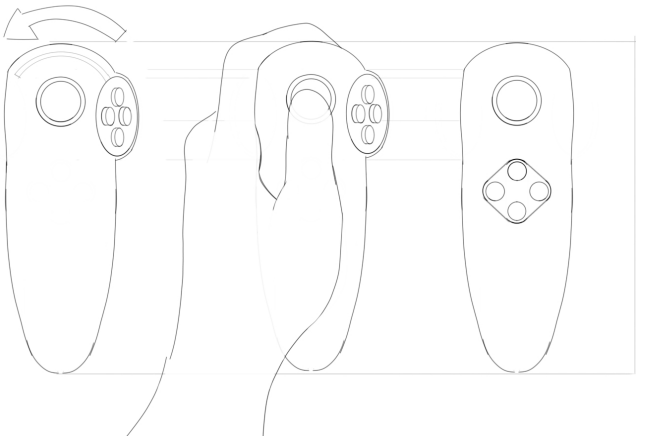
Based on my thesis defense as well as feedback at my senior show I saw opportunity to further develop my product. The following text highlights areas I have looked into.

I have separated each column into **ergonomics**, **function** and **story telling**. If given the opportunity to further develop my product, this is the route I would take.

If I were to continue my design I would use what I learned from my appearance model to keep adjusting my form. I found issues in hitting the “a,b,x and y” buttons while using the thumb stick. The design should let the user use both.

To continue in ergonomic development of my product, I would have needed to perform additional user testing to find the best placement of the buttons on the front face of the Primary Controller.

Currently, the way the controller is laid out, the user has to use the fat of their hand to push buttons while using the thumb stick. This works, but not for precise pushes and can lead to issues in competitive play. To fix this issue, I would make two additional controllers with different designs and (similar to this model) make working buttons and ask users to judge their success.



Ideally, I would like to perform user testing now with the ergonomics of my final form compared to the ergonomics of traditional competitive controllers. This way I can see how my form could be something able players would also like to use which would de-stigmatize the use of a one handed controller.

To continue in form development with my product, I would perform user testing, using my appearance model in comparison with a traditional competitive gaming controller.

To set up my test, I would start each player in the game "Overwatch". I would enter the practice range (A single player game mode where you practice game play by shooting npc robots who do not fire back) and I would ask the player to navigate the map and reach points which I designate in advance. This will allow me to observe and record how easily each player is able to navigate the camera and movement of the Omni Controller compared to a traditional controller.

The competitive players will be observed because they can give feedback on how their experience compares to a traditional controller. The one hand players will be observed because they can give insight in how this experience compares to their use and workarounds of how they use traditional one handed controllers.

One issue I had in the development of my form was creating a cohesive product line. My three products do not share enough characteristics to be seen as a kit. In my form development, I used the base of the tabletop controller to create the form for the step controller. The issue in this is the step controller was developed after the tabletop controller was developed. If I could go back I would develop both accessories at the same time and try and match form to the primary controller.

I would also apply my logo to my product line and further develop a color scheme which promotes a cohesive design. I would apply the logo to the back of each product or would have embedded the shape into the plastic using solidworks.

Creating a uniform design will better tell the story of my product and help the user understand how my products interact.